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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of

Hironobu ISHIKAWA, et al.

Appln. No.: 10/090,267

Confirmation No.: 6535

Filed: March 07, 2002

Docket No: Q68736

Group Art Unit: 2652

Examiner: David Donald Davis

For: CERAMIC DYNAMIC-PRESSURE BEARING AND HARD DISK DRIVE USING THE SAME

SUBMISSION OF APPEAL BRIEF

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith please find an Appeal Brief. A check for the statutory fee of $500.00 is attached. The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account. A duplicate copy of this paper is attached.

Respectfully submitted,

Terrance J. Wikberg
Registration No. 47,177

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860
WASHINGTON OFFICE
23373
CUSTOMER NUMBER

Date: February 28, 2005

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For: CERAMIC DYNAMIC-PRESSURE BEARING AND HARD DISK DRIVE USING THE SAME

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with the provisions of 37 C.F.R. § 41.37, Appellant submits the following:

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I. REAL PARTY IN INTEREST

The real party in interest is NGK SPARK PLUG CO., LTD. of Aichi, Japan, the assignee of the present application. The assignment was recorded on June 21, 2002 at Reel 013022, Frame 0216.

II. RELATED APPEALS AND INTERFERENCES

Appellant, Appellant's legal representatives, and the assignee in this application are not aware of any other pending appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the instant appeal.

III. STATUS OF CLAIMS

Claims 1 through 40 are all of the claims pending in the present application, and currently claims 1-32, 34-38 and 40 stand rejected. Claims 33 and 39 have been withdrawn from consideration and have not been examined on their merits.

This is an appeal from the Examiner's Final Office Action, dated July 14, 2004 rejecting claims 1-32, 34-38 and 40. The claims pending on appeal are set forth in Appendix A, attached to this Brief on Appeal.

IV. STATUS OF AMENDMENTS

There are no outstanding, non-entered amendments of the claims.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention is directed to a ceramic dynamic-pressure bearing and a hard disk including a motor rotation output section comprising the ceramic dynamic-pressure bearing. A discussion of the related art is found on pages 1-3 of the present application. The present invention is generally directed to solving problems associated with start up or stopping of dynamic pressure bearings, where problems such as wear or linking can occur.

A concise description of the claimed subject matter of the present invention is set forth below, with regard to each of the respective independent claims. The following includes reference to various portions of the present application as an aid to understanding the invention. However, such reference is only intended to point out the described exemplary embodiments, and not to limit the scope of the claims.

Because of the similarity in subject matter, independent claims 1, 29-32 and 34 will be discussed together, while independent claims 15, 35-38 and 40 will be discussed together.

Claims 1, 29-32 and 34:

The present invention, as set forth in claims 1, 29-32 and 34, is directed to a ceramic dynamic-pressure bearing, having various attributes as shown in Figures 4(a) and 4(b), reproduced below.

Fig. 4 (a)

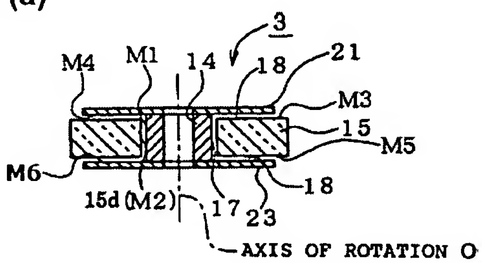
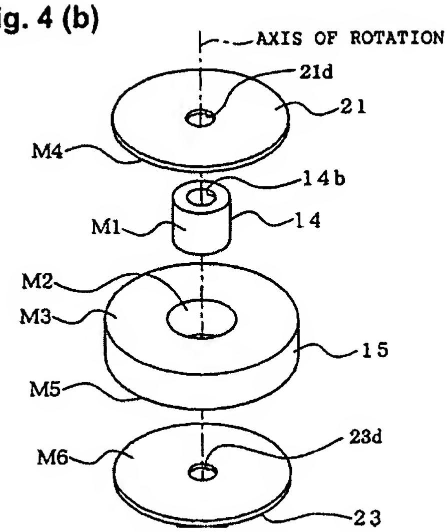


Fig. 4 (b)



Ceramic dynamic-pressure bearing 3 contains a number of components, at least some of which are formed of ceramic. Specifically, the bearing 3 contains a first member 14 that is formed of ceramic and has a cylindrical outer surface M1, and a second member 15 that is also formed of ceramic and has a cylindrical reception hole 15a (*see* Figure 3) formed therein. The first member 14 is inserted into the reception hole 15a of the second member 15, such that the first member 14 is rotatable, relative to the second member, about an axis O. Additionally, the bearing 3 contains a thrust plate 21 or 23 that is also formed of ceramic and faces at least one end face M3 or M5 of the second member 15 as viewed along the axis of rotation. The end face M3 or M5 of the second member 15 and a face M4 or M6 of the thrust plate 21 or 23 in opposition to the end face M3 or M5 serve as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap 18 therebetween.

An example is shown in Figure 4a (above), where the surface M3 of the second member 15 opposes the face M4 of the thrust plate 21 to define the gap 18. Additionally and

alternatively, the gap 18 is defined by the surface M5 of the member 15 and the face M6 of the thrust plate 23. *See* Specification, page 31, para. 89 to page 33, para. 92.

In the claimed invention, as set forth in claim 1, the bearing 3 satisfies any one of the following requirements:

1) The thrust dynamic-pressure gap definition surface M3 or M5 of the second member 15 which faces the thrust plate 21 or 23, respectively, has a flatness of not greater than 3 μm;[1] or

2) The thrust dynamic-pressure gap definition surface M4 or M6 of the thrust plate 21 or 23, respectively, which faces the second member 15 has a flatness of not greater than 3 μm;[2] or

3) The thrust dynamic-pressure gap definition surface M3 or M5 of the second member 15 which faces the thrust plate 21 or 23, respectively, and the thrust dynamic-pressure gap definition surface M4 or M6 of the thrust plate 21 or 23, respectively, which faces the second member 15 have a total flatness of not greater than 3 μm;[3]

4) The thrust dynamic-pressure gap definition surface M3 or M5 of the second member 15 which faces the thrust plate 21 or 23, respectively, is crowned such that an inner circumferential portion 15d (*see* Figure 7) thereof projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion 15c

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[1] *See also* claim 29, in which the claimed bearing 3 has this characteristic.

[2] *See also* claim 30, in which the claimed bearing 3 has this characteristic.

[3] *See also* claim 31, in which the claimed bearing 3 has this characteristic.

thereof (This embodiment is shown in at least Figures 7, 8d and 8f of the present application.);[4] or

5) The thrust dynamic-pressure gap definition surface M4 or M6 of the thrust plate 21 or 23, respectively, which faces the second member 15 is crowned such that an inner circumferential portion thereof projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion thereof (This embodiment is shown in at least Figures 8e and 8f of the present application.); or

6) A clearance between the mutually facing thrust dynamic-pressure gap definition surfaces M3 and M5, and M4 and M6 of the second member 15 and the thrust plate 21 or 23, respectively, is greater than 0 μm and not greater than 2.5 μm as measured at outermost circumferential portions of the thrust dynamic-pressure gap definition surfaces. (This embodiment is shown in at least Figures 8a through 8f of the present application.)[5]

See Specification, page 33, para. 95, and page 40, para. 109 to page 42, para. 116.

Claims 15, 35-38 and 40:

The present invention, as set forth in claims 15, 35-38 and 40, is directed to a hard disk drive which contains a motor having a motor rotation output section, where the motor rotation output section contains a ceramic dynamic-pressure bearing, having various attributes, and a hard disk rotatably mounted on the motor. To aid in the following discussion, Figure 3 of the present application has been reproduced below.

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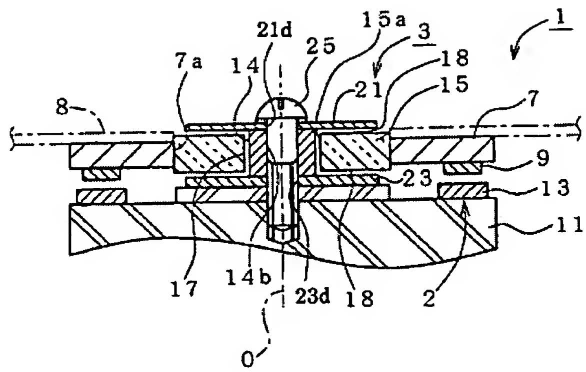
[4] *See also* claim 32, in which the claimed bearing 3 has this characteristic.

Fig. 3



Hard disk drive 1 contains a motor 2 and a motor rotation output section, shown in Figure 3, which contains a ceramic dynamic-pressure bearing 3.[6] The bearing 3 contains a number of components, at least some of which are formed of ceramic. Specifically, the bearing 3 contains a first member 14 that is formed of ceramic and has a cylindrical outer surface M1, and a second member 15 that is also formed of ceramic and has a cylindrical reception hole 15a (*see* Figure 3) formed therein. The first member 14 is inserted into the reception hole 15a of the second member 15, such that the first member 14 is rotatable, relative to the second member, about an axis O. Additionally, the bearing 3 contains a thrust plate 21 or 23 that is also formed of ceramic and faces at least one end face M3 or M5 of the second member 15 as viewed along the axis of rotation. The end face M3 or M5 of the second member 15 and a face M4 or M6 of the thrust

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[5] *See also* claim 34, in which the claimed bearing 3 has this characteristic.

[6] The following discussion of the bearing 3 is the same or similar to that set forth above regarding claims 1, 29-32 and 34, as these aspects of the claims are similar.

plate 21 or 23 in opposition to the end face M3 or M5 serve as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap 18 therebetween.

An example, of this is shown in Figure 4a (above), where the surface M3 of the second member 15 opposes the face M4 of the thrust plate 21 to define the gap 18. Additionally and alternatively, the gap 18 is defined by the surface M5 of the member 15 and the face M6 of the thrust plate 23. *See* Specification, page 31, para. 89 to page 33, para. 92.

Finally, the hard disk drive additionally contains a hard disk 8 which is mounted on the motor 2.

In the claimed invention, as set forth in claim 15, the bearing 3 satisfies any one of the following requirements:

1) The thrust dynamic-pressure gap definition surface M3 or M5 of the second member 15 which faces the thrust plate 21 or 23, respectively, has a flatness of not greater than 3 μm;[7] or
2) The thrust dynamic-pressure gap definition surface M4 or M6 of the thrust plate 21 or 23, respectively, which faces the second member 15 has a flatness of not greater than 3 μm;[8] or
3) The thrust dynamic-pressure gap definition surface M3 or M5 of the second member 15 which faces the thrust plate 21 or 23, respectively, and the thrust dynamic-pressure gap

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[7] *See also* claim 35, in which the claimed bearing 3 has this characteristic.

[8] *See also* claim 36, in which the claimed bearing 3 has this characteristic.

definition surface M4 or M6 of the thrust plate 21 or 23, respectively, which faces the second member 15, have a total flatness of not greater than 3 μm;[9]

4) The thrust dynamic-pressure gap definition surface M3 or M5 of the second member 15 which faces the thrust plate 21 or 23, respectively, is crowned such that an inner circumferential portion 15d (*see* Figure 7) thereof projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion 15c thereof (This embodiment is shown in at least Figures 7, 8d and 8f of the present application.);[10] or

5) The thrust dynamic-pressure gap definition surface M4 or M6 of the thrust plate 21 or 23, respectively, which faces the second member 15 is crowned such that an inner circumferential portion thereof projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion thereof (This embodiment is shown in at least Figures 8e and 8f of the present application.); or

6) A clearance between the mutually facing thrust dynamic-pressure gap definition surfaces M3 and M5, and M4 and M6 of the second member 15 and the thrust plate 21 or 23, respectively, is greater than 0 μm and not greater than 2.5 μm as measured at outermost

[9] *See also* claim 37, in which the claimed bearing 3 has this characteristic.

[10] *See also* claim 38, in which the claimed bearing 3 has this characteristic.

circumferential portions of the thrust dynamic-pressure gap definition surfaces. (This embodiment is shown in at least Figures 8a through 8f of the present application.)[11] *See* Specification, page 33, para. 95, and page 40, para. 109 to page 42, para. 116.

[11] *See also* claim 40, in which the claimed bearing 3 has this characteristic.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-2, 14-16, 28-32, 34-38 and 40 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,283,491 to Jabbar et al.

Claims 3-14 and 17-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Jabbar in view of NIST Property Data Summaries.

VII. ARGUMENT

Appellants' arguments for patentability are set forth in detail below. The claims do not stand and fall together. Particularly, Appellants request the Board to consider separate patentability of claims grouped as indicated below. Furthermore, the following arguments apply to all of the claims, unless otherwise indicated.

35 U.S.C. § 102(b) Rejection - Claims 1-2, 14-16, 28-32, 34-38 and 40:

Claims 1-2, 14-16, 28-32, 34-38 and 40 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,283,491 to Jabbar et al.

Claims 1-2, 14-16, 28-32, 34-38 and 40:

Jabbar discloses an air-bearing motor assembly for magnetic recording systems. Specifically, Jabbar discloses a cylindrical motor shaft **25** which is inserted into a through hole in a rotating sleeve member **42**, where the rotating sleeve **42** is positioned between lower and upper bases **43** and **44**.[12] Each of the bases **43** and **44** have thrust bearing surfaces **11** and **14** formed at an inner circumferential position, as shown in Figure 2.

Additionally, Jabbar discloses that the motor shaft **25** is made of steel,[13] the sleeve member **42** is made from aluminum or plastic[14] and the non-rotating lower and upper bases **43**

[12] *See* Jabbar, Figure 2, col. 6, lines 3-62 and col. 7, lines 11-22.

[13] *See id.* at col. 4, line 9.

[14] *See id.* at col. 7, line 18-19.

and **44** are preferably made from aluminum or plastic.[15] In Jabbar, only the thrust bearings **11** and **14** are "essentially covered with dry lubricated plastic or ceramic."[16]

Jabbar discloses that at least the sleeve member **42** is made of aluminum or plastic to provide for compatible thermal expansion properties with at least the hub **12**.[17]

In rejecting the above claims, the Examiner alleged that Jabbar teaches each and every feature of the claimed invention, as set forth in the above claims. Specifically, the Examiner equated the motor shaft **25** with the claimed "first member" and the sleeve member **42** with the claimed "second member." Further, the Examiner alleged that:

> [A]pplicant only claims thrust bearings being made of ceramic. As stated supra, Jabbar et al shows in figures 2, 3 and 9 a ceramic dynamic-pressure bearing including *a first member 25 formed of ceramic* (see column 7, lines 23-42) and having a cylindrical outer surface. A *second member 42 formed of ceramic* and having a cylindrical reception hole formed is shown in figures 2 and 3 of Jabbar et al.[18]

Thus, the Examiner alleges that Jabbar teaches that at least both of the shaft **25** and sleeve **42** are made of ceramic. Appellants disagree. As discussed in detail above, Jabbar discloses that the motor shaft **25** is made of <u>steel</u>,[19] the sleeve member **42** is made from <u>aluminum or plastic</u>[20] and the non-rotating lower and upper bases **43** and **44** are preferably made from <u>aluminum or</u>

[15] *See id.* at col. 6, lines 60-62.

[16] *See id.* at col. 7, lines 31-32.

[17] *See id.* at col. 7, lines 18-20.

[18] *See* Final Office Action dated July 14, 2004, pages 5-6, para. 8 (emphasis added).

[19] *See* Jabbar, col. 4, line 9 (emphasis added).

plastic.[21] In fact, as noted above, only the thrust bearings **11** and **14** are "essentially covered with dry lubricated plastic or ceramic."[22]

Appellants have carefully reviewed the entire disclosure of the Jabbar reference and, contrary to the Examiner's assertion, have found no disclosure, teaching or suggestion of any of the shaft **25** or sleeve **42** being made of ceramic, as required by claims 1-2, 14-16, 28-32, 34-38 and 40.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co of California*, 814 F.2d 628, 631 (Fed. Cir. 1987). As discussed and shown above, Jabbar fails to anticipate because it does not describe shaft **25** (said to correspond to the claimed "first member") and sleeve **42** (said to correspond to the claim "second member") formed of ceramic.

Moreover, the Examiner has made no reference or intimation that the missing claim features are "inherent" in the Jabbar disclosure. Therefore, this will not be discussed further.

In view of the foregoing, Jabbar fails to disclose each and every feature of the claimed invention. As such, the Examiner has failed to establish that Jabbar anticipates. Therefore, the rejection of claims 1-2, 14-16, 28-32, 34-38 and 40 under 35 U.S.C. § 102(b) is improper and should be reversed.

Claims 29, 35 and 37:

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[20] *See id.* at col. 7, line 18-19 (emphasis added).

[21] *See id.* at col. 6, lines 60-62 (emphasis added).

[22] *Id.* at col. 7, lines 31-32.

Additionally and independently of the above discussion, Jabbar also fails to disclose a thrust dynamic-pressure gap definition surface of the sleeve **42** (said to correspond to the claimed "second member"), which faces the either of the bases **43** or **44** (said to correspond to the claimed "thrust plate"), having a flatness of not greater than 3 μm, as required by claims 29, 35 and 37.

First, the Examiner has not identified any disclosure in Jabbar which discloses this claim feature. Second, Appellants have reviewed the disclosure of Jabbar and have found no such disclosure or teaching. Jabbar only discloses that it "is imperative that the inner cylindrical wall of sleeve members **21** and **22** are extremely smooth along with the outer surface of the motor shafts **25**."[23] Not only does the reference to "extremely smooth" fail to disclose the above claim limitation (i.e. "flatness of not greater than 3 μm"), this disclosure is only directed to the sleeve members **21** and **22**, and the shaft **25**. There is no disclosure regarding the surfaces of the sleeve **42**.

In view of the foregoing, Jabbar fails to disclose each and every feature of the claimed invention, as set forth in claims 29, 35 and 37. As such, the Examiner has failed to establish that Jabbar anticipates. Therefore, the rejection of claims 29, 35 and 37 under 35 U.S.C. § 102(b) is improper and should be reversed.

[23] *Id.* at col. 4, line 67 to col. 5, line 1.

Claims 30, 31, 36 and 37:

Additionally and independently of the above discussion, Jabbar also fails to disclose a thrust dynamic-pressure gap definition surface of either of the bases **43** or **44** (said to correspond to the claimed "thrust plate") which faces the sleeve **42** (said to correspond to the claimed "second member") having a flatness of not greater than 3 μm, as required by claims 30, 31, 36 and 37.

First, the Examiner has not identified any disclosure in Jabbar which discloses this claim feature. Second, Appellants have reviewed the disclosure of Jabbar and have found no such disclosure or teaching. Jabbar only discloses that it "is imperative that the inner cylindrical wall of sleeve members **21** and **22** are extremely smooth along with the outer surface of the motor shafts **25**."[24] Not only does the reference to "extremely smooth" fail to disclose the above claim limitation (i.e. "flatness of not greater than 3 μm"), this disclosure is only directed to the sleeve members **21** and **22**, and the shaft **25**. There is no disclosure regarding the surfaces of the bases **43** or **44**.

In view of the foregoing, Jabbar fails to disclose each and every feature of the claimed invention, as set forth in claims 30, 31, 36 and 37. As such, the Examiner has failed to establish that Jabbar anticipates. Therefore, the rejection of claims 30, 31, 36 and 37 under 35 U.S.C. § 102(b) is improper and should be reversed.

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[24] *Id.* at col. 4, line 67 to col. 5, line 1.

Claims 32 and 38:

Additionally and independently of the above discussion, Jabbar fails to disclose having any surface of the sleeve **42** (said to correspond to the claimed "second member") which faces the bases **43** or **44** (said to correspond to the claimed "thrust plate") crowned such that an inner circumferential portion of the sleeve **42** projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion of the sleeve **42**, as required by claims 32 and 38.

First, in alleging that this claim feature is disclosed in Jabbar, the Examiner states that "since the surfaces are at an angle, which gradually increases, the surfaces meet the [claim] requirements."[25] Contrary to the Examiner's assertion, this disclosure is insufficient to establish anticipation under 35 U.S.C. § 102. The mere fact that Jabbar discloses an angled surface dos not describe the specific limitations set forth in the claims. Namely, under the Examiner's reasoning, Jabbar could equally disclose an inner circumferential portion of the sleeve **42** projecting by an amount greater than 5 μm with respect to an outermost circumferential portion of the sleeve **42.** Thus, the Examiner's assertion of anticipation is improper, even under principles of "inherency," because the claimed limitations are <u>not</u> necessarily present in Jabbar. Second, Appellants have reviewed the disclosure of Jabbar and have found no express disclosure or teaching of the above claimed subject matter. Jabbar only discloses that "laterally extending axial surface **103** of base **43** and laterally extending axial surface **105** of the base **44** each make

[25] *See* Final Office Action dated July 14, 2004, page 3.

an angle of approximately 60 to 80 degrees with respect to the vertical axis of motor shaft."[26] However, without more, such as physical dimensions of the surfaces, the claim limitations are not met.

In view of the foregoing, Jabbar fails to disclose each and every feature of the claimed invention, as set forth in claims 32 and 38. As such, the Examiner has failed to establish that Jabbar anticipates. Therefore, the rejection of claims 32 and 38 under 35 U.S.C. § 102(b) is improper and should be reversed.

35 U.S.C. § 103(a) Rejection - Claims 3-13 and 17-27:

Claims 3-14 and 17-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Jabbar in view of NIST Property Data Summaries. However, since the NIST Property Data Summaries fail to cure the deficient teachings of Jabbar with respect claims 1 and 15, these claims are patentable, at least by reason of their dependency. Particularly, the NIST reference does not teach or suggest that motor shaft **25** or sleeve member **42** of Jabbar (the subject component said to correspond to the claimed "first member" and "second member", respectively) are desirably made of ceramic. Rather, the Examiner relies on the NIST reference merely as disclosing certain types of ceramics. Thus, the subject combination could never achieve the present invention because there is nothing in the prior art relied upon by the Examiner which teaches that shaft **25** and sleeve **42** should be made of ceramic in the first instance. Therefore, the rejection of claims 3-13 and 17-27 under 35 U.S.C. § 103(a) is improper and should be reversed.

[26] Jabbar, col. 7, lines 7-10.

Unless a check is submitted herewith for the fee required under 37 C.F.R. §41.37(a) and 1.17(c), please charge said fee to Deposit Account No. 19-4880.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

Terrance J. Wikberg
Registration No. 47,177

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
23373
CUSTOMER NUMBER

Date: February 28, 2005

CLAIMS APPENDIX

Claims 1-32, 34-38 and 40 on appeal are set forth below.

1. A ceramic dynamic-pressure bearing comprising:

a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween; and

the ceramic dynamic-pressure bearing satisfies at least one of the following requirements (i) to (vi):

(i) the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate has a flatness of not greater than 3 μm;

(ii) the thrust dynamic-pressure gap definition surface of the thrust plate which faces the second member has a flatness of not greater than 3 μm;

(iii) the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate and the thrust dynamic-pressure gap definition surface of the thrust plate which faces the second member have a total flatness of not greater than 3 μm;

(iv) the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate is crowned such that an inner circumferential portion thereof projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion thereof;

(v) the thrust dynamic-pressure gap definition surface of the thrust plate which faces the second member is crowned such that an inner circumferential portion thereof projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion thereof; and

(vi) a clearance between the mutually facing thrust dynamic-pressure gap definition surfaces of the second member and the thrust plate is greater than 0 μm and not greater than 2.5 μm as measured at outermost circumferential portions of the thrust dynamic-pressure gap definition surfaces.

2. The ceramic dynamic-pressure bearing as claimed in claim 1, wherein an inner surface of the reception hole of the second member and an outer circumferential surface of the first member to be received inside the inner surface serve as radial dynamic-pressure gap definition surfaces, which define a radial dynamic-pressure gap therebetween.

3. The ceramic dynamic-pressure bearing as claimed in claim 1, wherein the thrust dynamic-pressure gap definition surface of the thrust plate has a hardness lower than that of the thrust dynamic-pressure gap definition surface of the second member.

4. The ceramic dynamic-pressure bearing as claimed in claim 1, wherein the first member, the second member, and the thrust plate are formed of an alumina ceramic comprising ceramic crystal grains which contains an Al component in an amount of 90-99.5% by mass as reduced to Al_2O_3 and an oxide-type sintering aid component in an amount of 0.5-10% by mass as reduced to an oxide thereof.

5. The ceramic dynamic-pressure bearing as claimed in claim 4, wherein the alumina ceramic has an apparent density of 3.5-3.9 g/cm^3.

6. The ceramic dynamic-pressure bearing as claimed in claim 4, wherein the alumina ceramic has a relative density of not less than 90%.

7. The ceramic dynamic-pressure bearing as claimed in claim 4, wherein the ceramic crystal grains have an average grain size of 1-7 μm.

8. The ceramic dynamic-pressure bearing as claimed in claim 4, wherein, on the dynamic-pressure gap definition surface formed of alumina ceramic, ceramic crystal grains having a grain size of 2-5 μm occupy an area percentage of not less than 40%.

9. The ceramic dynamic-pressure bearing as claimed in claim 4, wherein the dynamic-pressure gap definition surface formed of alumina ceramic has surface pores having an average size greater than the average grain size of the ceramic crystal grains.

10. The ceramic dynamic-pressure bearing as claimed in claim 4, wherein surface pores present on the dynamic-pressure gap definition surface have an average size of 2-20 μm.

11. The ceramic dynamic-pressure bearing as claimed in claim 4, wherein, on the dynamic-pressure gap definition surface, surface pores having a size of 2-20 μm occupy an area percentage of 10-60%.

12. The ceramic dynamic-pressure bearing as claimed in claim 4, wherein ceramic forming the first member, the second member, and the thrust plate is a dense ceramic sintered body having a relative density of not less than 90%; and pores having a size of 2-20 μm present in the sintered body are localized mainly on the dynamic-pressure gap definition surface in the form of surface pores.

13. The ceramic dynamic-pressure bearing as claimed in claim 12, wherein the surface pores are formed as a result of ceramic crystal grains dropping off in the course of finishing the dynamic-pressure gap definition surface.

14. The ceramic dynamic-pressure bearing as claimed in claim 1, comprising dynamic-pressure grooves formed on at least one of the radial dynamic-pressure gap definition surfaces and the thrust dynamic-pressure gap definition surfaces

15. A hard disk drive comprising:

a motor including a motor rotation output section having a ceramic dynamic-pressure bearing comprising a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween; and

a hard disk rotatably mounted on the motor;

the hard disk drive further characterized in that the ceramic dynamic-pressure bearing satisfies at least one of the following requirements (i) to (vi):

(i) the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate has a flatness of not greater than 3 μm;

(ii) the thrust dynamic-pressure gap definition surface of the thrust plate which faces the second member has a flatness of not greater than 3 μm;

(iii) the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate and the thrust dynamic-pressure gap definition surface of the thrust plate which faces the second member have a total flatness of not greater than 3 μm;

(iv) the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate is crowned such that an inner circumferential portion thereof projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion thereof;

(v) the thrust dynamic-pressure gap definition surface of the thrust plate which faces the second member is crowned such that an inner circumferential portion thereof projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion thereof; and

(vi) a clearance between the mutually facing thrust dynamic-pressure gap definition surfaces of the second member and the thrust plate is greater than 0 μm and not greater than 2.5 μm as measured at outermost circumferential portions of the thrust dynamic-pressure gap definition surfaces.

16. The hard disk drive as claimed in claim 15, wherein an inner surface of the reception hole of the second member and an outer circumferential surface of the first member to be received inside the inner surface serve as radial dynamic-pressure gap definition surfaces, which define a radial dynamic-pressure gap therebetween.

17. The hard disk drive as claimed in claim 15, wherein the thrust dynamic-pressure gap definition surface of the thrust plate has a hardness lower than that of the thrust dynamic-pressure gap definition surface of the second member.

18. The hard disk drive as claimed in claim 15, wherein the first member, the second member, and the thrust plate are formed of an alumina ceramic comprising ceramic crystal grains which contains an Al component in an amount of 90-99.5% by mass as reduced to Al_2O_3 and an oxide-type sintering aid component in an amount of 0.5-10% by mass as reduced to an oxide thereof.

19. The hard disk drive as claimed in claim 18, wherein the alumina ceramic has an apparent density of 3.5-3.9 g/cm^3.

20. The hard disk drive as claimed in claim 18, wherein the alumina ceramic has a relative density of not less than 90%.

21. The hard disk drive as claimed in claim 18, wherein the ceramic crystal grains have an average grain size of 1-7 μm.

22. The hard disk drive as claimed in claim 18, wherein, on the dynamic-pressure gap definition surface formed of alumina ceramic, ceramic crystal grains having a grain size of 2-5 μm occupy an area percentage of not less than 40%.

23. The hard disk drive as claimed in claim 18, wherein the dynamic-pressure gap definition surface formed of alumina ceramic has surface pores having an average size greater than the average grain size of the ceramic crystal grains.

24. The hard disk drive as claimed in claim 18, wherein surface pores present on the dynamic-pressure gap definition surface have an average size of 2-20 μm.

25. The hard disk drive as claimed in claim 18, wherein, on the dynamic-pressure gap definition surface, surface pores having a size of 2-20 μm occupy an area percentage of 10-60%.

26. The hard disk drive as claimed in claim 18, wherein ceramic forming the first member, the second member, and the thrust plate is a dense ceramic sintered body having a relative density of not less than 90%; and pores having a size of 2-20 μm present in the sintered body are localized mainly on the dynamic-pressure gap definition surface in the form of surface pores.

27. The hard disk drive as claimed in claim 26, wherein the surface pores are formed as a result of ceramic crystal grains dropping off in the course of finishing the dynamic-pressure gap definition surface.

28. The hard disk drive as claimed in claim 15, comprising dynamic-pressure grooves formed on at least one of the radial dynamic-pressure gap definition surfaces and the thrust dynamic-pressure gap definition surfaces.

29. A ceramic dynamic-pressure bearing comprising:

a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween; and

the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate has a flatness of not greater than 3 μm.

30. A ceramic dynamic-pressure bearing comprising:

a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween; and

the thrust dynamic-pressure gap definition surface of the thrust plate which faces the second member has a flatness of not greater than 3 μm.

31. A ceramic dynamic-pressure bearing comprising:

a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween; and

the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate and the thrust dynamic-pressure gap definition surface of the thrust plate which faces the second member have a total flatness of not greater than 3 μm.

32. A ceramic dynamic-pressure bearing comprising:

a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween; and

the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate is crowned such that an inner circumferential portion thereof projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion thereof.

34. A ceramic dynamic-pressure bearing comprising:

a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first

member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween; and

a clearance between the mutually facing thrust dynamic-pressure gap definition surfaces of the second member and the thrust plate is greater than 0 μm and not greater than 2.5 μm as measured at outermost circumferential portions of the thrust dynamic-pressure gap definition surfaces.

35. A hard disk drive comprising:

a motor including a motor rotation output section having a ceramic dynamic-pressure bearing comprising a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween;

a hard disk rotatably mounted on the motor; and

the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate has a flatness of not greater than 3 μm.

36. A hard disk drive comprising:

a motor including a motor rotation output section having a ceramic dynamic-pressure bearing comprising a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween;

a hard disk rotatably mounted on the motor; and

the thrust dynamic-pressure gap definition surface of the thrust plate which faces the second member has a flatness of not greater than 3 μm.

37. A hard disk drive comprising:

a motor including a motor rotation output section having a ceramic dynamic-pressure bearing comprising a first member formed of ceramic and having a cylindrical outer surface, a

second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween;

a hard disk rotatably mounted on the motor; and

the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate and the thrust dynamic-pressure gap definition surface of the thrust plate which faces the second member have a total flatness of not greater than 3 μm.

38. A hard disk drive comprising:

a motor including a motor rotation output section having a ceramic dynamic-pressure bearing comprising a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as

thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween;

a hard disk rotatably mounted on the motor; and

the thrust dynamic-pressure gap definition surface of the second member which faces the thrust plate is crowned such that an inner circumferential portion thereof projects by an amount greater than 0 μm and not greater than 2.5 μm with respect to an outermost circumferential portion thereof.

40. A hard disk drive comprising:

a motor including a motor rotation output section having a ceramic dynamic-pressure bearing comprising a first member formed of ceramic and having a cylindrical outer surface, a second member formed of ceramic and having a cylindrical reception hole formed therein, the first member being inserted into the reception hole of the second member in such a manner as to be rotatable, relative to the second member, about an axis, and a thrust plate formed of ceramic facing at least one end face of the second member as viewed along the axis of rotation, the end face of the second member and a face of the thrust plate in opposition to the end face serving as thrust dynamic-pressure gap definition surfaces so as to define a thrust dynamic-pressure gap therebetween;

a hard disk rotatably mounted on the motor; and

a clearance between the mutually facing thrust dynamic-pressure gap definition surfaces of the second member and the thrust plate is greater than 0 μm and not greater than 2.5 μm as measured at outermost circumferential portions of the thrust dynamic-pressure gap definition surfaces.

EVIDENCE APPENDIX:

This Appendix is not applicable to this Appeal.

RELATED PROCEEDINGS APPENDIX

This Appendix is not applicable to this Appeal.